HIGHLIGHTS

REVISION NO. 33 Jun 01/10

Pages which have been revised are outlined below, together with the Highlights of the Revision

CH/SE/SU C PAGES	REASON FOR CHANGE	EFFECTIVITY
CHAPTER 80		
L.E.P. 1- 1	Revised to Reflect this revision indicating new,revised, and/or deleted pages	
80-13-01	Minor additions and amplification	
601- 602	REVISED INSPECTION/CHECK PROCEDURE OF PNEUMATIC STARTER.	

CHAPTER 80

STARTING

LIST OF EFFECTIVE PAGES

N, R or D indicates pages which are New, Revised or Deleted respectively
Remove and insert the affected pages and complete the Record of Revisions and the Record of Temporary Revisions as necessary

CH/SE/SU	C	PAGE	DATE
RECORD			
OF TEMP.			
REVISION			
L.E.P.	R	1- 1	Jun01/10
T. of C.		1	Jun01/07
80-00-00		1	Jun01/06
80-00-00		2	Jun01/04
80-00-00		3	Jun01/04
80-00-00		4	Dec01/90
80-00-00		5	Jun01/04
80-00-00		6	Jun01/04
80-00-00		7	Jun01/04
80-00-00		8	Jun01/04
80-00-00		301	Jun01/04
80-00-00		302	Jun01/04
80-10-00		1	Jun01/04
80-10-00		2	Jun01/04
80-10-00		3	Jun01/04
80-10-00		4	Jun01/04
80-10-00		5	Jun01/04
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80-10-00		7	Jun01/04
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80-13-00		902	Jun01/06
80-13-00		903	Jun01/05
80-13-00		904	Jun01/05
80-13-01		401	Jun01/04
80-13-01		402	Jun01/04
80-13-01		403	Jun01/04
80-13-01	R	601	Jun01/10
80-13-01	R	602	Jun01/10
80-13-01		603	Jun01/04
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80-13-08		402	Jun01/04
80-13-08		403	Jun01/04
80-13-08		404	Jun01/09
80-13-08		601	Jun01/07
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CHAPTER 80

STARTING

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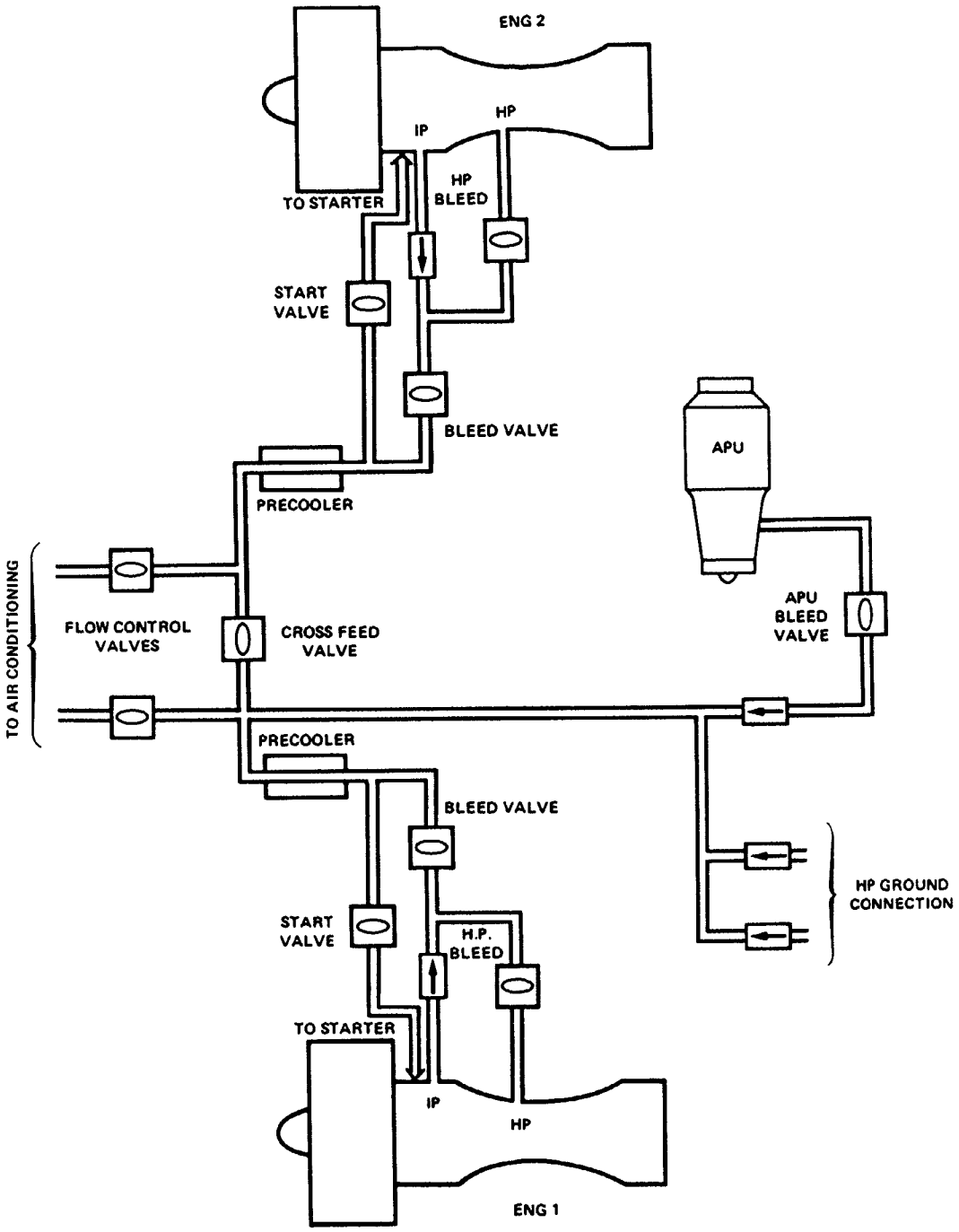
STARTING - GENERAL - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 001)
   The starter supply is controlled by a starter shut-off valve pneumatically operated and electrically controlled. In case or failure, the valve can be opened manually.
   Engine starting is controlled from **ENG START** panel **429VU**, located in the center of the overhead panel. For each engine, the illumination of the blue **OPEN** legend integral with **ENG START/START 1 (2)** pushbutton switch indicates that the start valve is open.
   The starting sequence may be interrupted at any time by placing **ENG START** selector switch in **OFF** position.
   A switch in the **N2** speed indicator causes the starter valve to close when the **N2** speed exceeds **45 %**. The starter centrifugal clutch then disconnects the starter turbine and gears from the output shaft and allows the turbine to stop rotating.
   (Ref. Fig. 002)

R 2. Electrical Supply
   (Ref. Fig. 003)

R 3. Control and Indicating (Ref. Fig. 004, 005)



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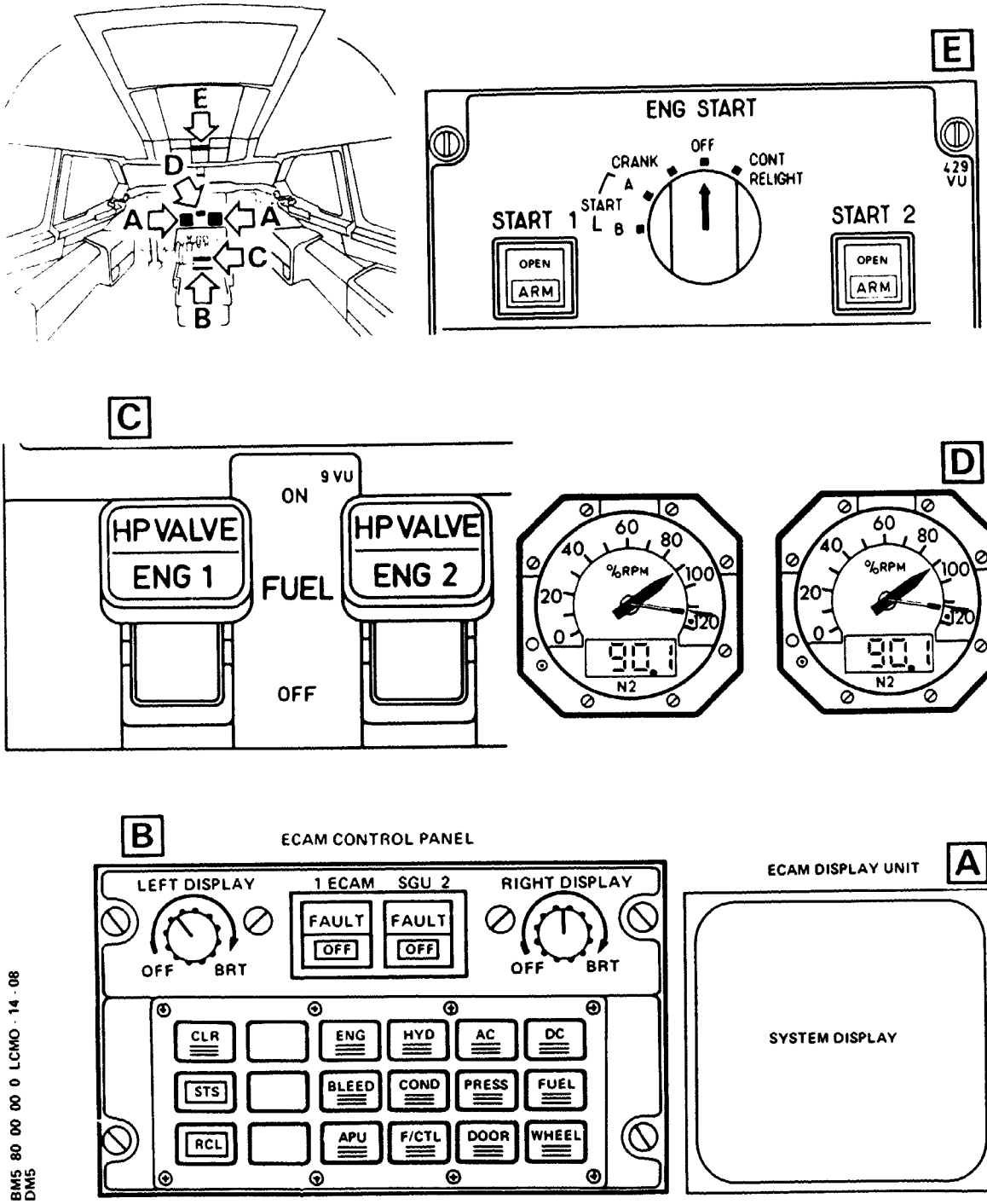
Starting - Pneumatic System Schematic
Figure 001



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Component Location - Control and Indicating
Figure 002

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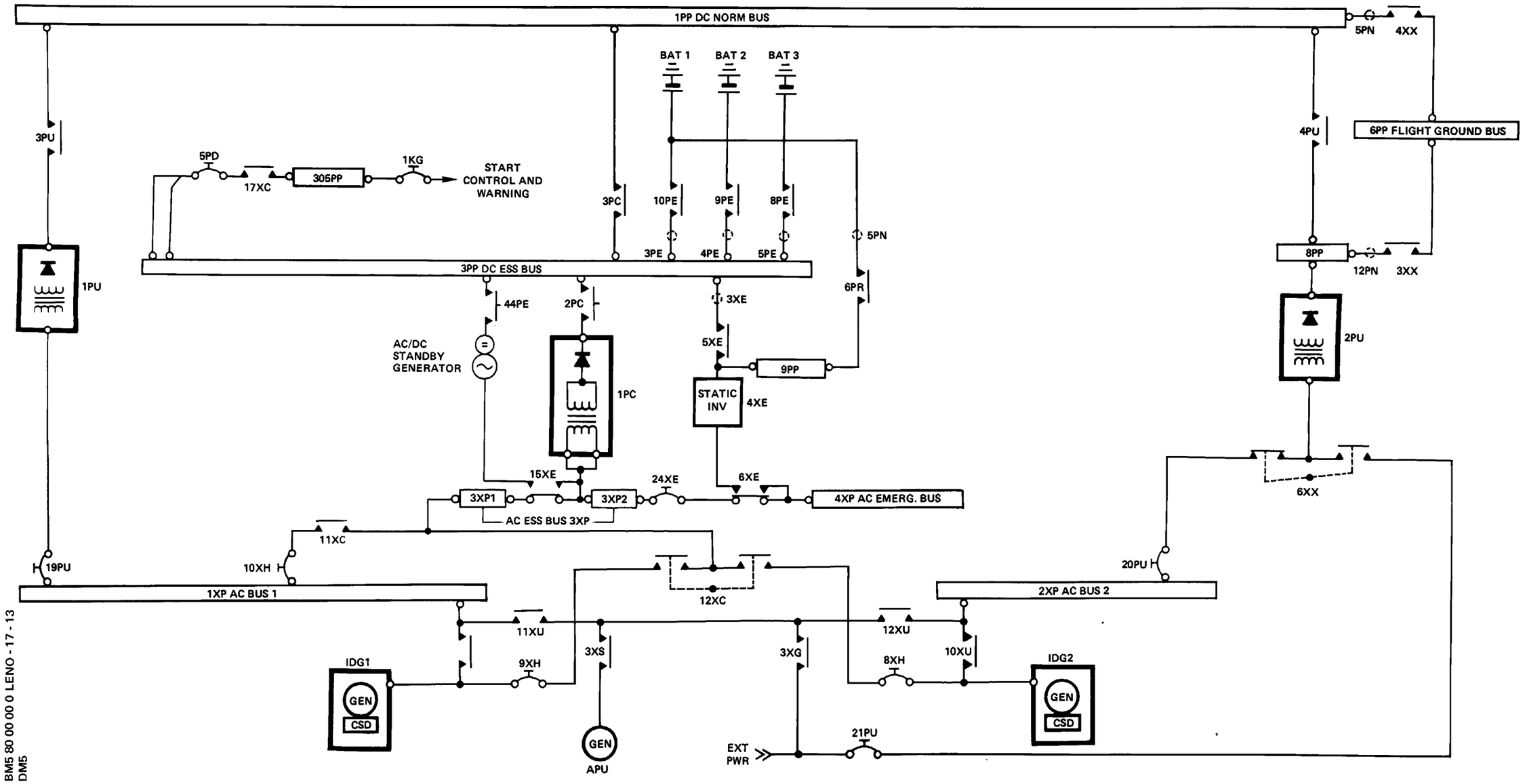
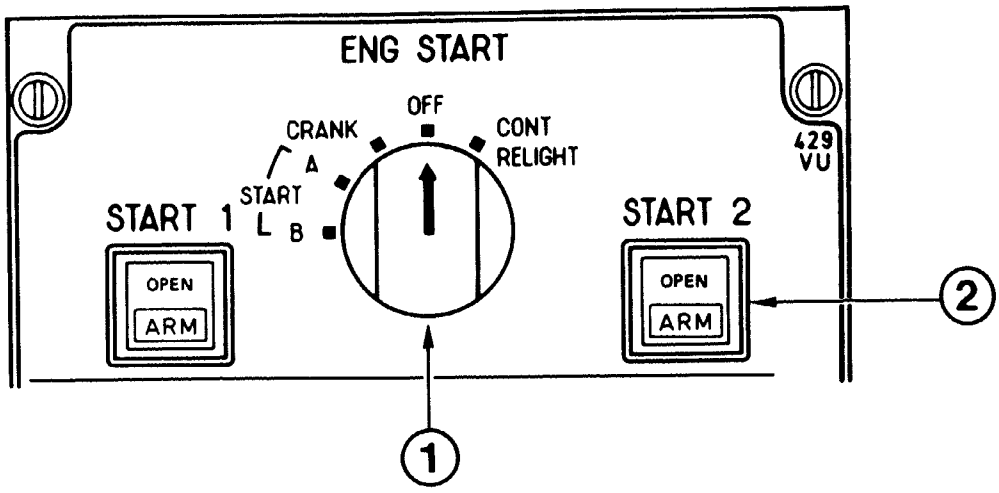


Starting - Electrical System
Figure 003



1 - IGNITION (ENG START) SELECTOR SWITCH
USED TO SELECT IGNITION MODE REQUIRED

OFF – IGNITION SYSTEMS OF BOTH ENGINES ARE INHIBITED
LATCHING OF ENG START 1 (2) PUSH-BUTTON SWITCH IS INHIBITED

CRANK – IGNITION SYSTEMS OF BOTH ENGINES ARE INHIBITED, BUT START SEQUENCE (REF. 80-00-00) CAN BE INITIATED TO DRY OR WET MOTORING CYCLES

START A (B) – IGNITION SYSTEM A (B) WILL BE ENERGIZED DURING ENGINE START SEQUENCE ONLY (REF. 80-00-00)

CONT RELIGHT – IGNITION SYSTEMS A AND B ARE ENERGIZED CONTINUOUSLY PROVIDED CORRESPONDING HP FUEL SHUT OFF VALVE CONTROL LEVER IS IN ON POSITION

NOTE : IRRESPECTIVE OF HP FUEL SHUT OFF VALVE CONTROL LEVER POSITION, THE LEFT ECAM DISPLAY UNIT WILL SHOW THE MESSAGE CONTINUOUS RELIGHT ON
CRANK, START A, START B POSITIONS CLOSE AIR CONDITIONING PACK VALVES.

2 - ENG START 1 (2) PUSHBUTTON SWITCH
IT IS USED TO INITIATE THE START SEQUENCE
RELEASED : NORMAL POSITION
ARM LEGEND (WHITE) COMES ON WITH ENG 1 AND ENG 2 N2 - 45% AND ENG START SELECTOR NOT IN OFF POSITION
PRESSED : ARM LEGEND (WHITE) COMES OFF
FUEL USED INDICATION IS RESET TO ZERO.
OPEN LEGEND (BLUE) COMES ON DURING THE TIME WHEN ENG 1 (2) START VALVE IS NOT IN FULLY CLOSED POSITION.
APU IF RUNNING, PROVIDES MAXIMUM AIRFLOW.

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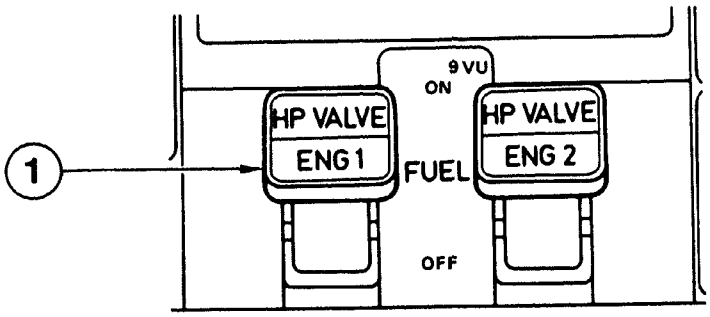
Ignition (ENG START) Selector Switch and
ENG START/START 1 (2) Pushbutton Switch
Figure 004



1. HP FUEL SHUT OFF VALVE CONTROL LEVER

ON – PERMITS IGNITION CIRCUITS OF CORRESPONDING ENGINE TO BE ELECTRICALLY SUPPLIED
OFF – IGNITION SYSTEMS A AND B OF CORRESPONDING ENGINE INHIBITED
NOTE – THIS LEVER ALSO CONTROLS THE FUEL SUPPLY TO THE COMBUSTION CHAMBER (REF. 76.00.00)

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HP Fuel Shut OFF Valve Control Lever
Figure 005

1. General

A. This procedure gives instructions for manually opening or closing a failed pneumatic starter shutoff valve during engine start procedure. The actual starting procedure remains unchanged.

B. Access to pneumatic starter shutoff valve manual override is via a hole in the thrust reverser latch access door at 6:00 o'clock.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Warning Notice
B.	Square Drive
Referenced Procedure - 71-00-00, P. Block 501	Power Plant

3. Procedure

WARNING : ALL SAFETY PRECAUTIONS MUST BE OBSERVED DURING ENGINE OPERATION, RESPECT SAFETY AREA ACCESS (REF. 71-00-00, P. BLOCK 501).

A. Job Set-Up
(1)Visually locate the access hole for the starter shutoff valve (6:00 o'clock on the thrust reverser).
(2)Establish communications between maintenance personnel on ground and in flight compartment.

B. Opening of Valve
(1)In flight compartment, press ENG START/START 1(2) pushbutton switch (Ref. 71-00-00, P. Block 501) and tell ground crew to open valve.
(2)On ground by means of a square drive, operate valve to open position (turn counterclockwise) and hold.
CAUTION : WHEN EXERCISING START VALVE MANUALLY, MAINTAIN A FIRM AND POSITIVE OPENING ACTION SO AS TO PREVENT CLOSING VALVE INADVERTENCY AND TO PREVENT ANY POSSIBILITY OF STARTER CRASH REENGAGEMENT.
(3)Starter valve opens
(a)On ENG START panel 429VU, START 1(2) pushbutton switch, blue OPEN legend comes on.
(b)Starter is engaged.

C. Closing of Valve
(1)In flight compartment, after engine starting when N2 reaches 44 - 46% (4300 - 4500 rpm) (Ref. 71-00-00, P. Block 501), tell ground crew to close valve.
(2)On ground by means of a square drive and wrench extension, operate valve to closed position (turn clockwise), remove square drive and move away from engine, respecting safety areas.

WARNING : ALL SAFETY PRECAUTIONS MUST BE OBSERVED DURING ENGINE OPERATION, RESPECT SAFETY AREA ACCESS (REF. 71-00-00, P. BLOCK 501).

(3)When valve is closed

(a)On **ENG START** panel 429VU, START 1(2) pushbutton switch, blue **OPEN** legend goes off.

(b)Starter is disengaged.

D. Close-Up

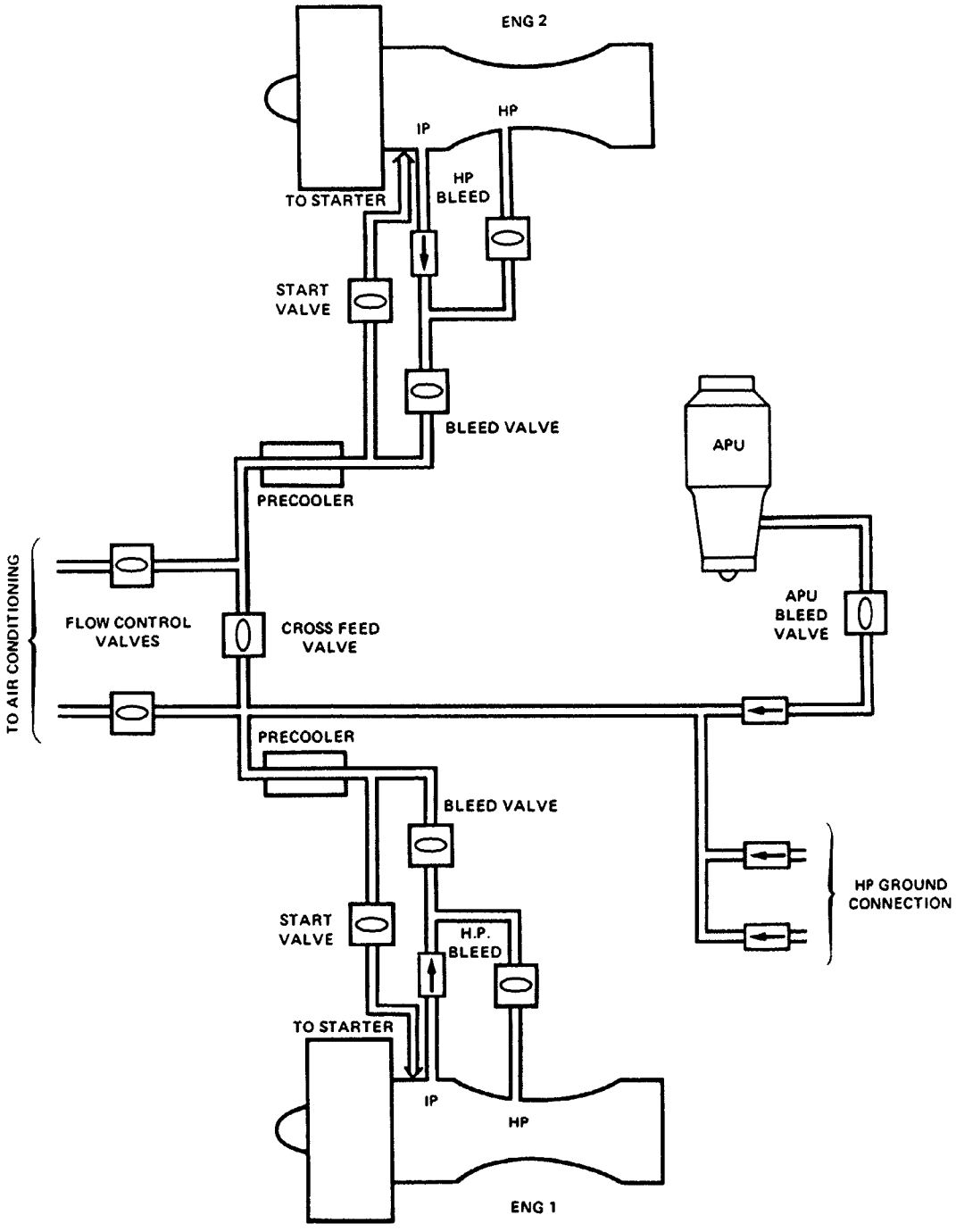
(1)Install a warning notice in flight compartment indicating that **ENG 1(2) START** valve is inoperative.

CRANKING - DESCRIPTION AND OPERATION

1. Air Supply (Ref. Fig. 001, 002)
The air necessary for starting comes from the duct connecting engine bleed and the pre-cooler via a 4 in. dia. duct. This duct is attached to the engine bleed duct just before the precooler inlet.
Through operation of the crossfeed valve and APU bleed valve, the air necessary for the starter is supplied by either :
- crossbleed from the other engine,
- the APU and in that case, all the air bled from the APU is used for starting,
- an external source able to supply a pressure between 25 and 55 psig (maximum permissible pressure in the duct).

2. Operation
Two types of operation can be performed with ENG START selector 3JH in CRANK position (Ref. 71-00-00, P. Block 501).
   (a) Dry motoring :
      will be needed when
      - it is necessary to eliminate any fuel accumulated in the combustion chamber
      - a leak check of engine system is needed.
   (b) Wet motoring
      will be needed when the integrity of the fuel system has to be checked.

3. Starter Valve (Ref. Fig. 003)
The valve is mounted in the starter air supply duct upstream of the starter in the engine core compartment. The butterfly type valve is normally spring and pressure loaded closed. An electrical signal from the flight compartment energizes the valve solenoid, causing the starter valve to open and admit air to the starter inlet. As engine core speed accelerates through the starter cutout speed of 45% N2, the flight compartment N2 indicator de-energizes the solenoid and the starter valve closes.
Actuation air is obtained from the starter valve inlet line. It is routed through a filter and an orifice, which controls the rate of valve opening. An electrical position switch is actuated by the butterfly shaft to provide flight compartment indication of valve position.
The valve may be manually opened by inserting a square drive wrench in the socket in the end of the butterfly shaft and rotating the shaft counter clockwise. The socket is accessible from the ground through an access door in the lower bifurcation of the fan reverser. It also serves as a visual indicator of valve position. In manual operation it is necessary to hold the valve open until the engine reaches a self-sustaining speed.



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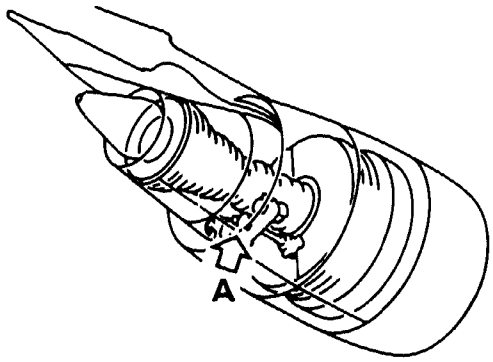
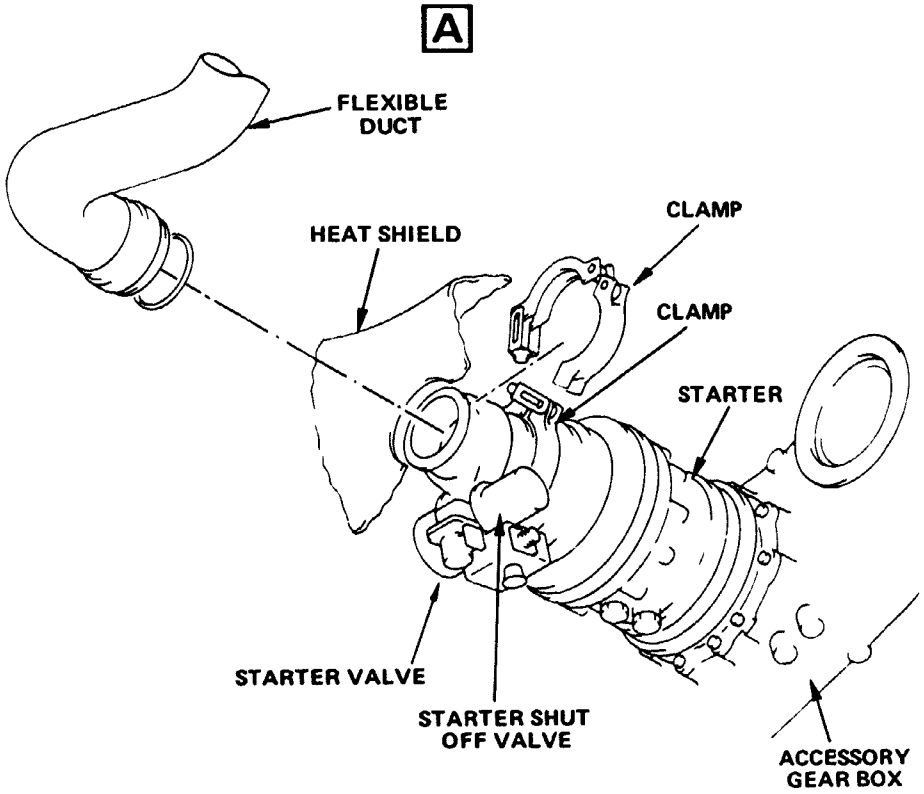
Starting - Pneumatic System Schematic
Figure 001





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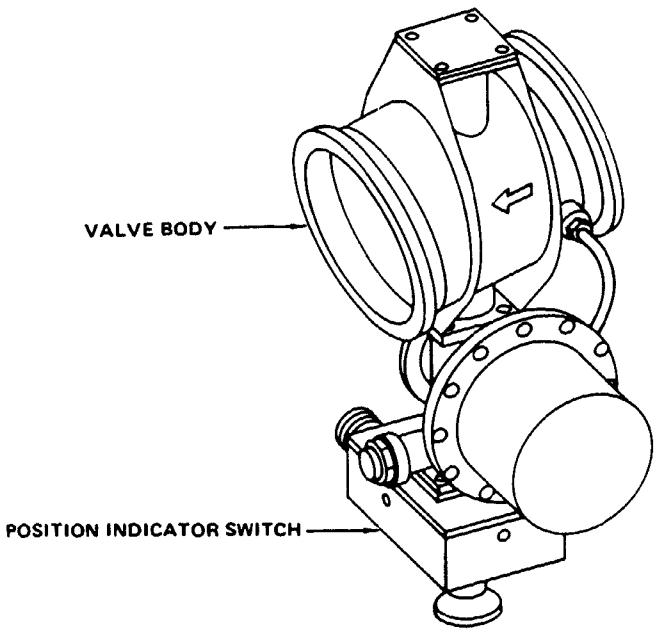
Pneumatic System
Figure 002



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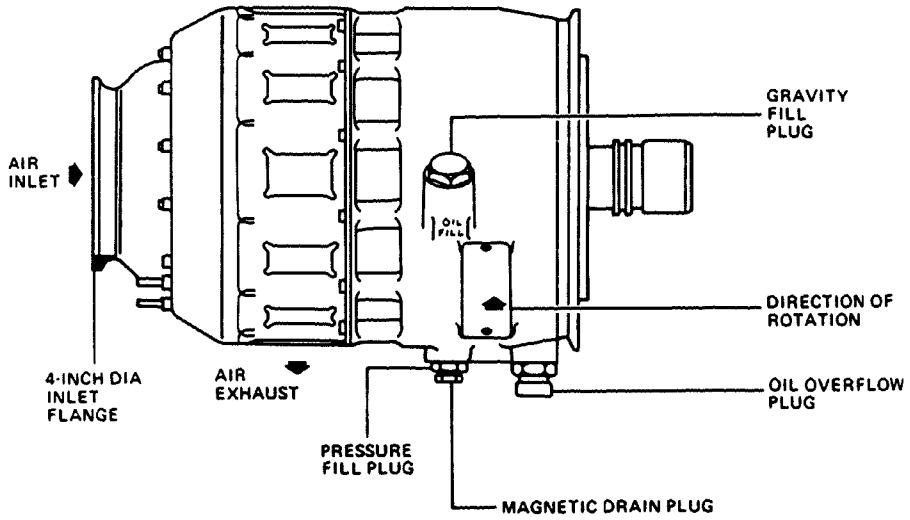
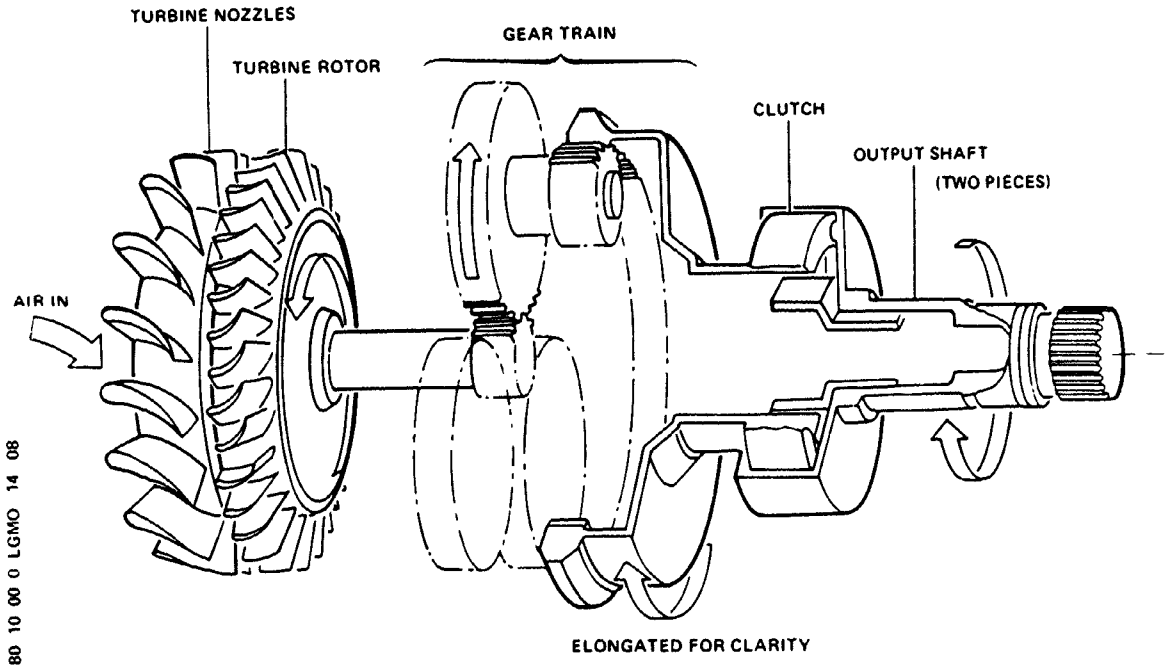
Starter Valve
Figure 003

4. Starter (Ref. Fig. 004, 005)
The starter drives the engine from zero N2 to approximately 15% N2 where engine fuel flow is started. It assists the engine up to approximately 45% N2 where the starter valve closes. Above 40% N2, and after starter airflow is off, the starter centrifugal clutch will disconnect the starter gears and turbine from the output shaft. The clutch will re-engage when engine speed falls below 30% N2.
The starter operating cycle is five minutes with two minutes cooling. After the first cycle, repeat operation requires ten minutes cooling between each cycle.
The starter is lubricated by the same type of oil as the engine. The oil capacity is marked on the name plate.





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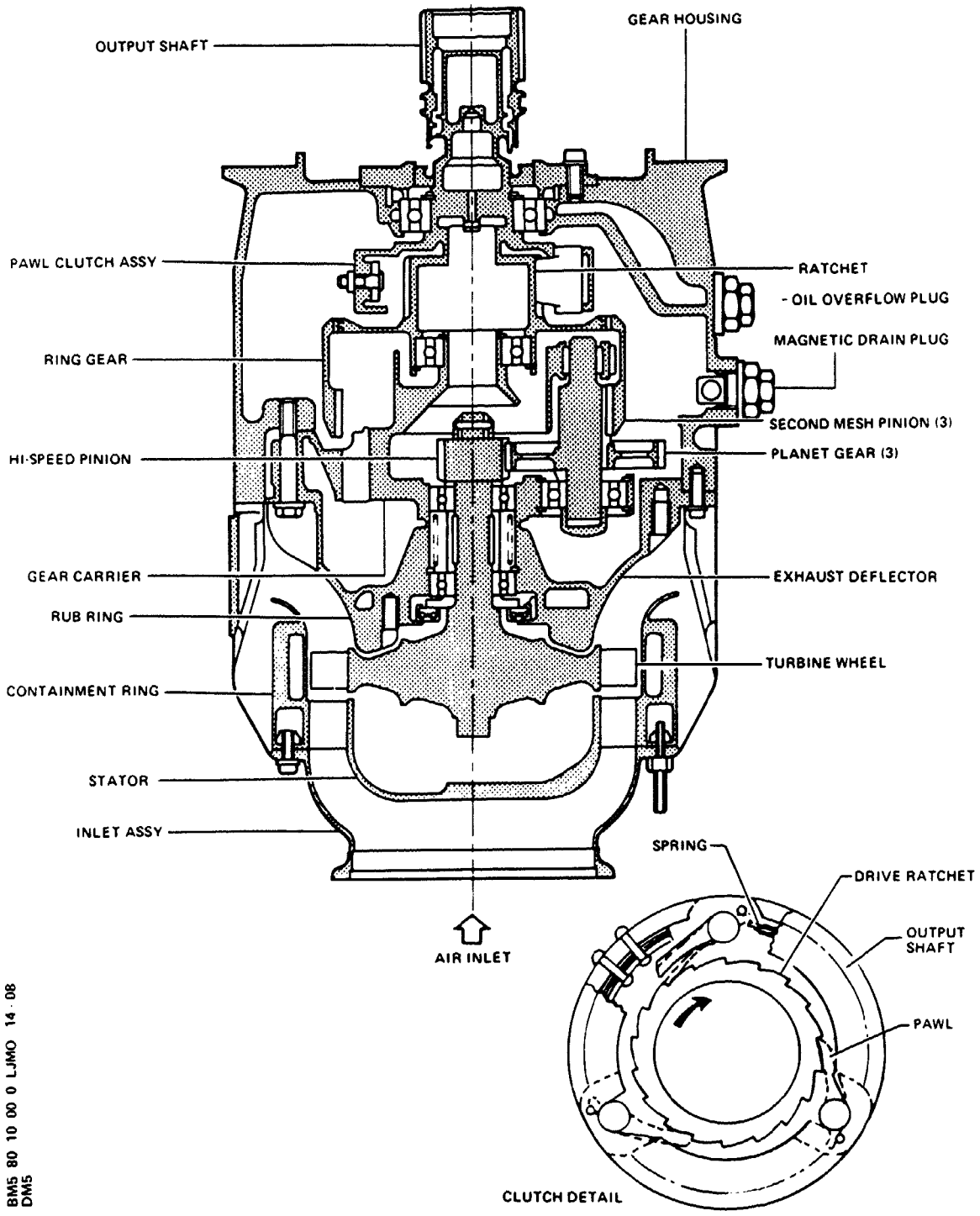
Pneumatic Starter - Operating Principle
Figure 004



Pneumatic Starter - Cross Section
Figure 005

CONTROL AND INDICATING - DEACTIVATION/REACTIVATION

Ref. : MMEL Section 1-80, ITEM 1 (Start valve "OPEN" lt.)

1. Reason for the Job

A. Failure of start valve 1 (2) indicating system

2. Equipment and Materials

ITEM	DESIGNATION
A.	Warning Notice
B.	Square Drive

3. Procedure

A. Job Set-Up
(1)Insert square drive through hole in access door 452CR(462CR).

B. Deactivation
(1)After engine start cycle, check that start valve is in closed position by turning the square drive clockwise.

C. Close-Up
(1)Remove square drive.
(2)Install a warning notice in flight compartment indicating that start valve 1 (2) indicating system is inoperative.

D. Reactivation
(1)Refer to TSM 71-00-00, 80-00-00.

PNEUMATIC STARTER AND STARTER CONTROL VALVE SYSTEM - DEACTIVATION/REACTIVATION

Reference : MEL Section 1-80, Item 2 (Starter control valve system)
CAUTION : THE FOLLOWING PROCEDURE MUST BE PERFORMED BEFORE EVERY FLIGHT UNDER THIS MMEL ITEM. IF YOU DO NOT, THAT COULD LEAD TO AN IN-FLIGHT SHUTDOWN.

1. General
This procedure tells how to manually start the engine and check the correct closed position of the pneumatic starter valve after the manual engine start. This procedure must be done before each flight under this MMEL item.

2. Reason for the Job
Failure of the pneumatic starter valve system

3. Manual Engine Start and Pneumatic Starter Valve Check in Closed Position

A. Equipment and Materials

ITEM	DESIGNATION
(1)	Speeder Handle
(2)	Square Drive - 3/8 in. (9.52 mm) X 36 in. (1 m) long extension
Referenced Procedures	
- 71-00-00, P. Block 501	Power Plant
- 72-00-00, P. Block 501	Engine

B. Procedure
(1)Job set-up
(a)Before you go near the operating engine, prepare the speeder handle and square drive.
(b)Manually operate the pneumatic starter valve during engine start (Ref. 80-00-00, P. Block 301).
(2)Check the closed position of the pneumatic starter valve after the manual engine start (Ref. Fig. 901)
WARNING : ALL SAFETY PRECAUTIONS MUST BE OBSERVED DURING ENGINE OPERATION, RESPECT SAFETY AREA ACCESS (REF. 71-00-00, P. BLOCK 501 AND REF. 72-00-00, P. BLOCK 501).
(a)Get access to the pneumatic starter valve manual drive and position indicator (female square drive) directly from the ground using the speeder handle and square drive.
(b)Align the speeder handle and square drive correctly with the hole in the access panel and the guide tube inside the cowl.
(c)Push the speeder handle and square drive up until you engage the square drive on the speeder handle with the manual drive and position indicator (3) of the starter control valve.
(d)When the manual drive and position indicator (3) is fully engaged in the pneumatic starter valve, try to turn the speeder handle clockwise.
1 The pneumatic starter valve butterfly is correctly closed if :
- you cannot turn the speeder handle clockwise from the position it

initially engages,
- or you feel the tool against the stop.

2 The pneumatic starter valve butterfly is not correctly closed if you can turn the speeder handle clockwise against the stop.

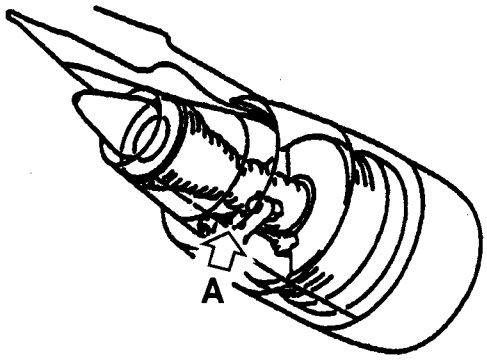
(e)Keep the speeder handle aligned with the pneumatic starter valve manual drive and position indicator (3) and carefully disengage it from the pneumatic starter valve. Move the speeder handle and square drive out of the guide tube and access panel.

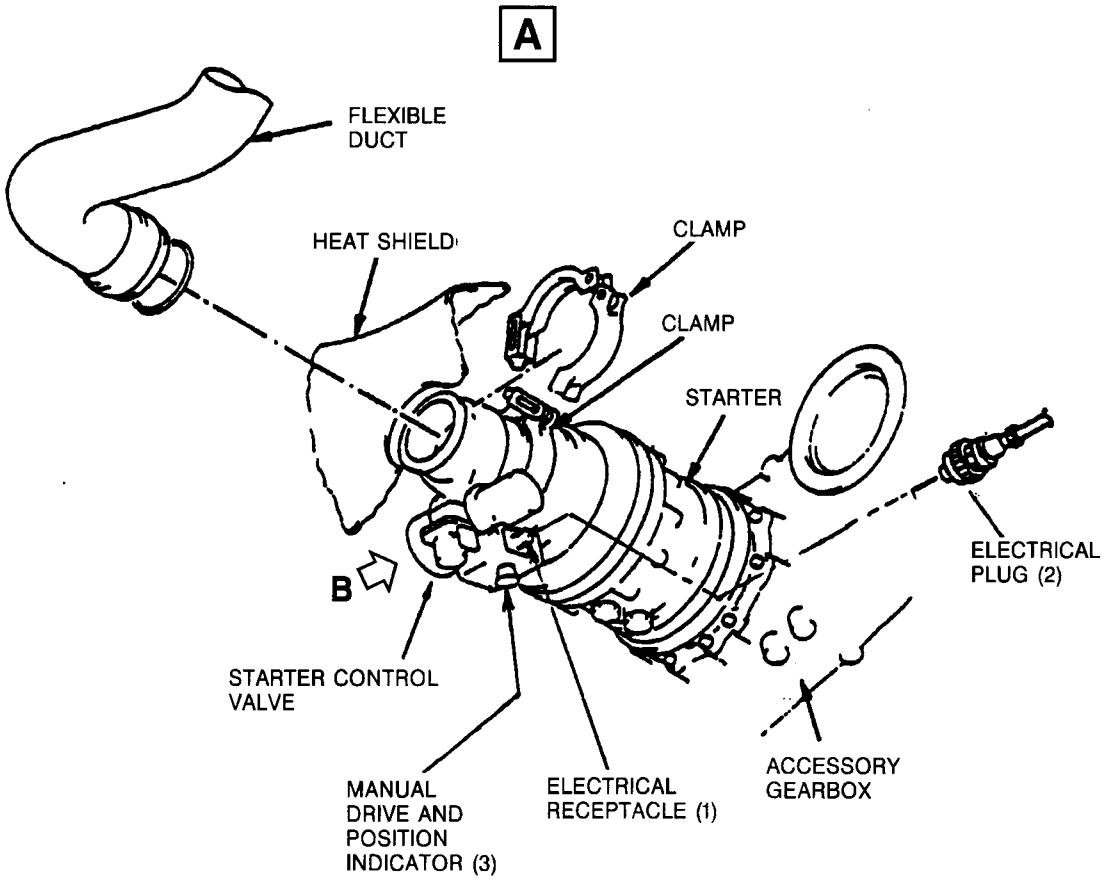
4. Reactivation

A. Troubleshoot starting system (Ref. TSM 71-02).

B. Remove warning notice.

C. Start and shut down engine (Ref. 71-00-00, P. Block 501).





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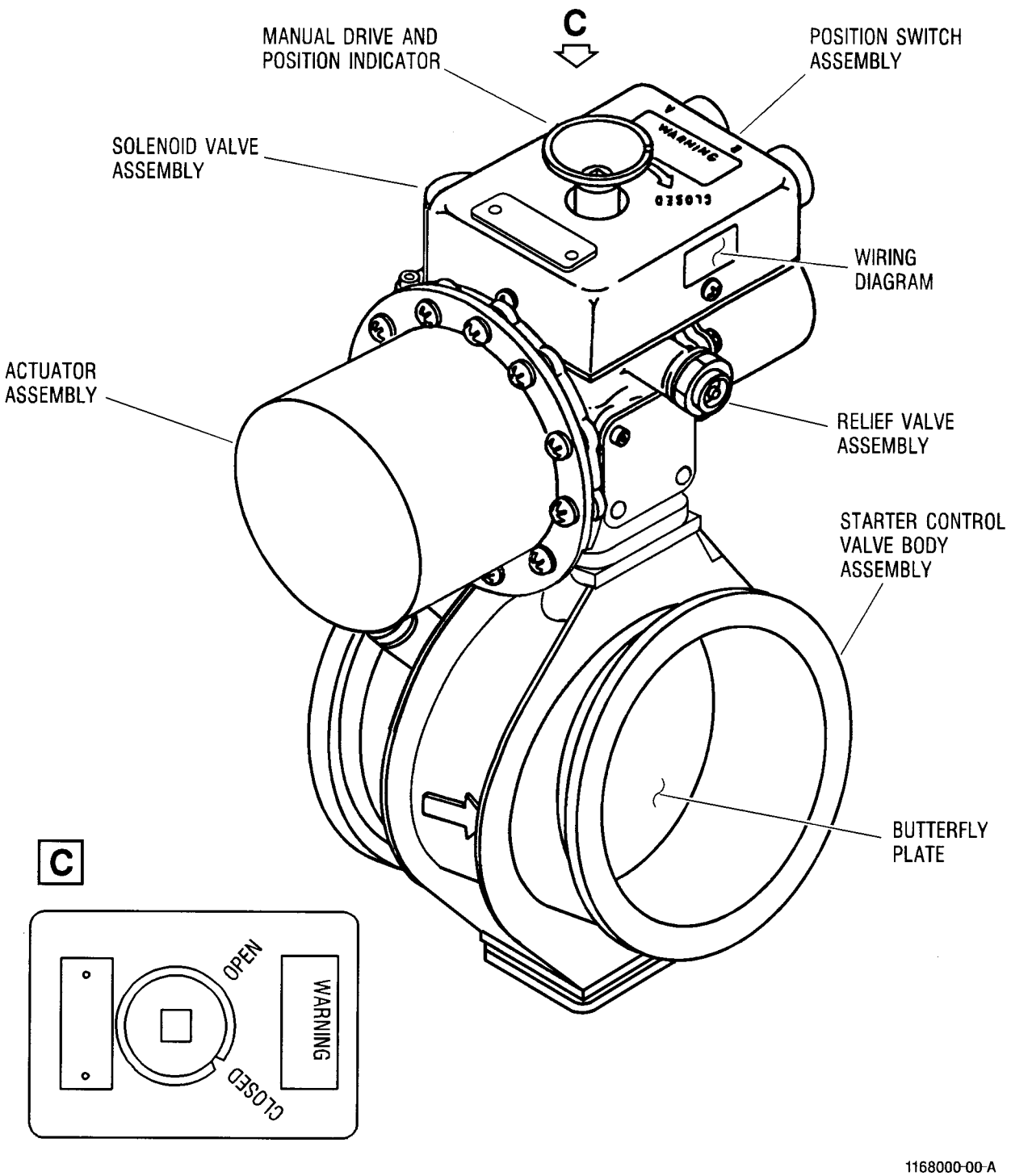
Pneumatic System (Sheet 1/2)
Figure 901

R

B



Pneumatic System (Sheet 2/2)
Figure 901

R

PNEUMATIC STARTER - REMOVAL/INSTALLATION

1. General

This procedure pertains to the removal and installation of the pneumatic starter. The starter is mounted on the aft side of the accessory gearbox. Access to the starter is gained by opening the thrust reverser cowl doors.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Container - Capacity : 19 liters (5 Gallons)
C.	Caps and Plugs
D. Material No.C02-019	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)

Referenced Procedures

- 12-13-80, P. Block 1	Starting System
- 71-00-00, P. Block 501	Power Plant-General
- 71-13-00, P. Block 301	Cowl Doors
- 80-13-02, P. Block 401	Pneumatic Starter Valve

3. Procedure

WARNING : SUPPORT STARTER ADEQUATELY BEFORE REMOVING FROM GEARBOX. WEIGHT OF STARTER IS APPROXIMATELY 40 POUNDS (18.1 KG).

CAUTION : DO NOT LIFT STARTER BY OUTPUT SHAFT. THE SPRING RETAINER MAY SNAP OUT AND ALLOW STARTER TO DROP. NEVER REST STARTER ON OUTPUT SHAFT.

A. Job Set-Up

(1)Open, safety and tag the circuit breakers for the appropriate engine and open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

(2)Remove starter control valve (Ref. 80-13-02, P. Block 401).

B. Removal of Pneumatic Starter (Ref. Fig. 401)

(1)Remove coupling clamp securing starter to accessory gearbox mounting pad.

(2)Withdraw starter from accessory gearbox pad until shaft spline is free of the gearbox spline.

(3)Remove preformed packings from starter shaft and starter pad. Discard packings.

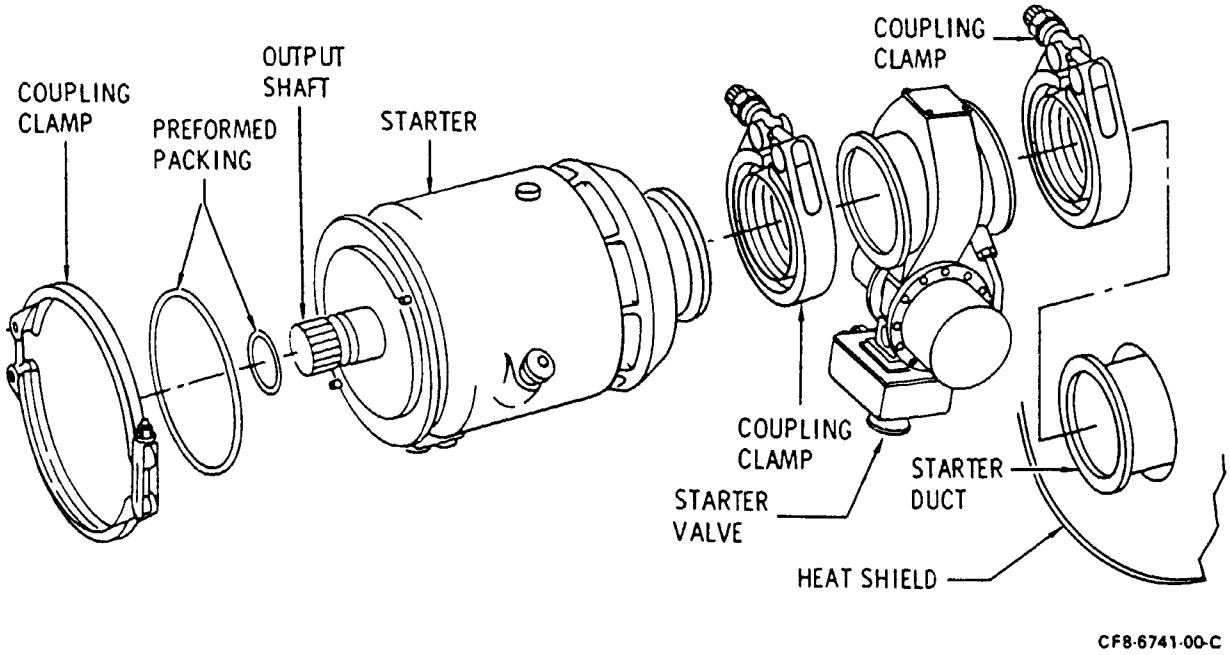
(4)Install protective covers on all starter openings and accessory gearbox pad.

C. Installation of Pneumatic Starter (Ref. Fig. 401)

WARNING : A DANGEROUS OIL LEAK MAY OCCUR IF STARTER SHAFT PREFORMED PACKING IS NOT INSTALLED TO THE DRIVE SHAFT DURING THE STARTER INSTALLATION.

(1)Lightly coat a preformed packing with engine oil (Material No.C02-019) and install on starter output shaft.

NOTE : Make sure packing is installed in proper groove, not spline relief groove.



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Pneumatic Starter Removal/Installation
Figure 401

(2)Lightly coat a preformed packing with engine oil (Material No.C02-019) and install on starter gearbox pad.
(3)Install starter on gearbox pad, making sure mating splines and dowel pins are aligned properly.
(4)Install coupling clamp, and TORQUE nut to between 115 and 125 lbf.in. (1.29-1.41 m.daN).

D. Close-Up and Test
(1)Install starter control valve (Ref. 80-13-02, P. Block 401).
(2)Service starter with engine oil (Ref. 12-13-80, P. Block 1).
(3)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(4)Close thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).
(5)Remove safety clip and tag and close circuit breaker 1KG.
(6)Perform 80% N2 engine run (Ref. 71-00-00, P. Block 501) and check starter for proper operation and oil leakage. No leakage is permitted.
(7)Close fan cowl doors (Ref. 71-13-00, P. Block 301).
Remove safety clips and tags and close circuit breakers.

PNEUMATIC STARTER - INSPECTION/CHECK

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B. Material No.C02-019	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
C.	Torque Wrench 8-85 lbf.in. (0.09 - 0.96 m.daN)
D.	Lockwire, 0.032 Corrosion Resistant Steel
Referenced Procedures	
- 12-13-80, P. Block 1	Starting System
- 71-13-00, P. Block 301	Cowl Door
- 80-13-01, P. Block 401	Pneumatic Starter

2. Procedure

A. Job Set-Up
(1)Open, safety and tag circuit breakers, for the appropriate engine and open thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

B. Inspect for Metal Particles as follows :

R NOTE : There are 2 starter configurations used on the 80C2 engines :
R Configuration No. 1 includes a liquid level sight glass.
R Configuration No. 2 does not include a liquid level sight glass.
R Both configurations No. 1 and No. 2 mount with a V-band clamp.

(1)Remove the magnetic probe from the magnetic drain plug assembly and discard the gasket. The plug assembly has a check valve to permit probe removal without draining oil from the starter.

R NOTE : When removing the probe, make sure that stray metal shavings
R and slivers from tool box or work area do not attach to it before you examine it. Make sure you put the magnetic probe in a clean area.

(2)Check probe for amount and type of contaminants. Replace the starter (Ref. 80-13-01, P. Block 401) if :

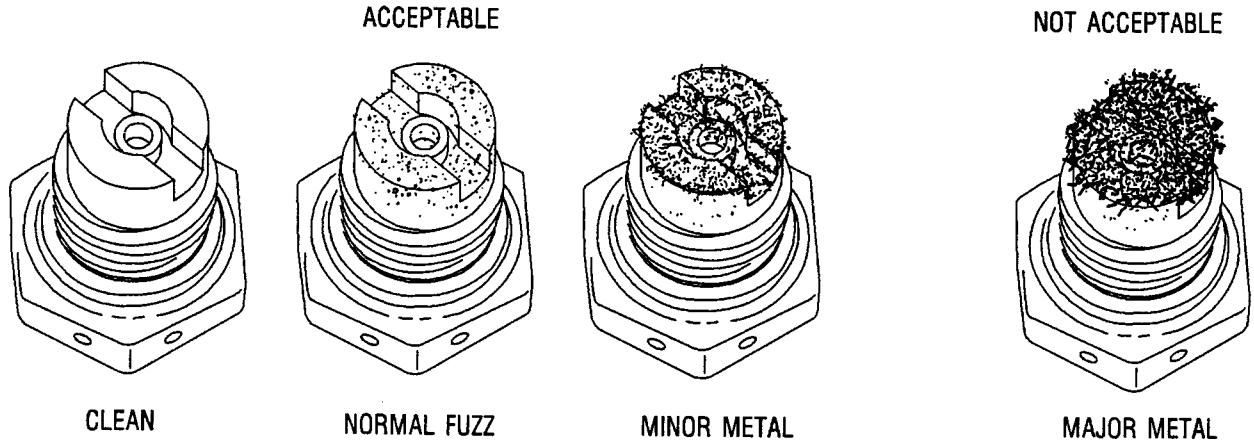
R (a)The probe appears to have a large amount of contamination (Ref. Fig. 601)
or
(b)The size of the particles or fragments is larger than 0.1 in. (2.5 mm) in any dimension.

NOTE : A small accumulation of fine slivers and relatively flat flakes of metal indicate normal wear. A larger accumulation of particles in chunk or chip form indicates possible internal damage.

OPTIONAL : If you are not sure if the contamination is more than the amount (Ref. Fig. 601), clean the probe and keep the removed particles. Fill starter with oil again, do a motoring procedure on the starter for approximately 1-2 minutes, then inspect starter magnetic probe again. If you see contamination on the probe, replace the starter.

(3)Install the magnetic probe into the drain plug :
(a)Lightly coat new preformed packing with engine oil (Material No. C02-019) and install on magnetic probe.
R (b)If drain plug was removed, install drain plug assembly with new
R preformed packing and tighten drain plug as follows :
R 1 Configuration No. 1 incorporates a liquid level sight glass.
R TORQUE the drain plug to between 10 and 25 lbf.in. (0.11 and
R 0.28 m.daN).
R 2 Configuration No. 2 without a liquid level sight glass.
R TORQUE the drain plug to between 70 and 80 lbf.in. (0.79 and
R 0.90 m.daN).
R NOTE : Make sure the open side of the preformed packing is against
R the drain plug.
R (c)Install probe into the magnetic plug and tighten the magnetic plug
R as follows :
R 1 Configuration No. 1 incorporates a liquid level sight glass.
R TORQUE to between 5 and 15 lbf.in. (0.06 and 0.17 m.daN).
R 2 Configuration No. 2 without a liquid level sight glass.
R TORQUE to between 20 and 40 lbf.in. (0.23 and 0.45 m.daN).
R (4)Attach the magnetic drain plug and the magnetic probe with safety wire.
R (5)Do the servicing of the starter (Ref. 12-13-80, P. Block 1).

C. Close-Up
(1)Close thrust reverser cowl door (Ref. 71-13-00, P. Block 301).
(2)Remove safety clips and tags and close circuit breakers.



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Magnetic Drain Plug Inspection
Figure 601

PNEUMATIC STARTER VALVE - REMOVAL/INSTALLATION

Access to starter valve is through the fan reverser cowl door.

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
Referenced Procedures	
- 71-13-00, P. Block 301	Cowl Doors
- 71-00-00, P. Block 501	Power Plant - General

2. Procedure

A. Job Set-Up
(1)Open safety and tag the appropriate circuit breakers and open left the fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

B. Removal (Ref. Fig. 401)
(1)Disconnect the electrical connector from the start valve.
(a)Install the caps on all openings.
(2)Make sure the alignment stripe is painted on the starter and the start valve.
NOTE : The stripe aligns the start valve with the starter during installation.
NOTE : When you change the valve you can ignore the alignment marks.
(a)If the alignment stripe is not shown, make a new alignment stripe.
(3)Remove the coupling V-band clamps which attach the start valve to the starter and the starter duct.
(4)Remove the start valve.
NOTE : Garrett start valve on the Electronic Propulsion Control System (EPCS) engines do not have the E-seal between the start valve and the starter.
(a)Remove the E-seal between the start valve and the starter duct.
(b)Remove the E-seal between the starter and the start valve.
(c)Remove the start valve.
(5)Examine the E-seals and for damage. Discard the E-seal if you see damage.
(6)Install the caps on all openings.

C. Installation (Ref. Fig. 401)
NOTE : Garrett start valve on the Electronic Propulsion Control System (EPCS) engines do not have the E-seal between the start valve and the starter.
(1)Remove the caps from the starter and the starter duct.
(2)Install the E-seal in an open end of the starter duct.
(3)Install the E-seal in an open end of the starter.
(4)Install the start valve between the starter and the starter duct.
NOTE : When you replace the valve, align the valve visually with the

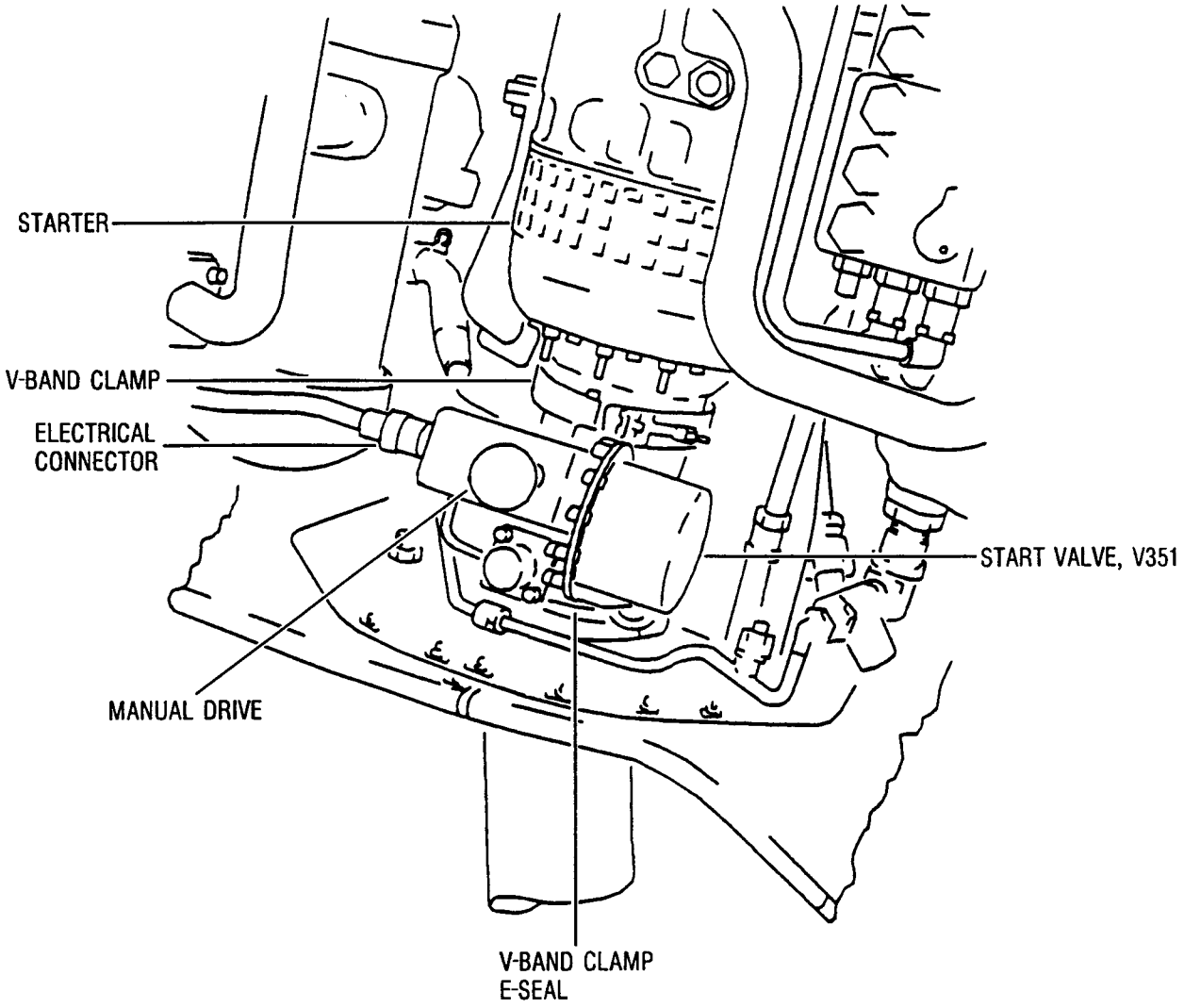
manual override access hole.
(a)Align the stripe on the start valve with the stripe of the starter.
(b)Install the V-band clamps on each side of the start valve.
NOTE : Move the clamp nuts until they can be tightened through the IDG OIL SERVICE door.
(c)Tighten the V-band clamps with your hand at this time.
(d)Hit the clamps lightly with a soft mallet to make sure the valve is in the correct position.
(5)Connect the electrical connector to the start valve solenoid.
(a)Remove the caps from the electrical connectors.
(b)Connect the electrical connector to the start valve solenoid.
(6)Close the thrust reversers (Ref. 71-13-00, P. Block 301).
(7)Open the IDG OIL SERVICE door on the left thrust reverser.
(8)Make sure the manual operation shaft socket is aligned with the guide tube access port on the right side of the fan reverser.
(a)Adjust the position of the start valve if it is necessary.
(9)Tighten the V-band clamp between the starter and the start valve.
NOTE : There are two types of the clamps for this installation. Use the torque values identified on the clamp.

CLAMP MANUFACTURER	TORQUE VALVE
Aeroquip	60-70 lbf.in (0.68-0.79 m.daN)
Janitrol	90-100 lbf.in. (1.02-1.13 m.daN)

(10)TORQUE the V-band clamp between the start valve and the starter duct to between 100 and 115 lbf.in. (1.13 and 1.30 m.daN).
(11)Close the IDG OIL SERVICE door on the left thrust reverser.

D. Test
(1)Remove safety clips and tags and close circuit breakers.
(2)Dry motor engine (Ref. 71-00-00, P. Block 501).
(3)Check for air leakage.

E. Close-Up
(1)Make sure your work area is clean and clear of tools and miscellaneous items of equipment.
(2)Close thrust reverser and cowl doors (Ref. 71-13-00, P. Block 301).



GARRETT START VALVE

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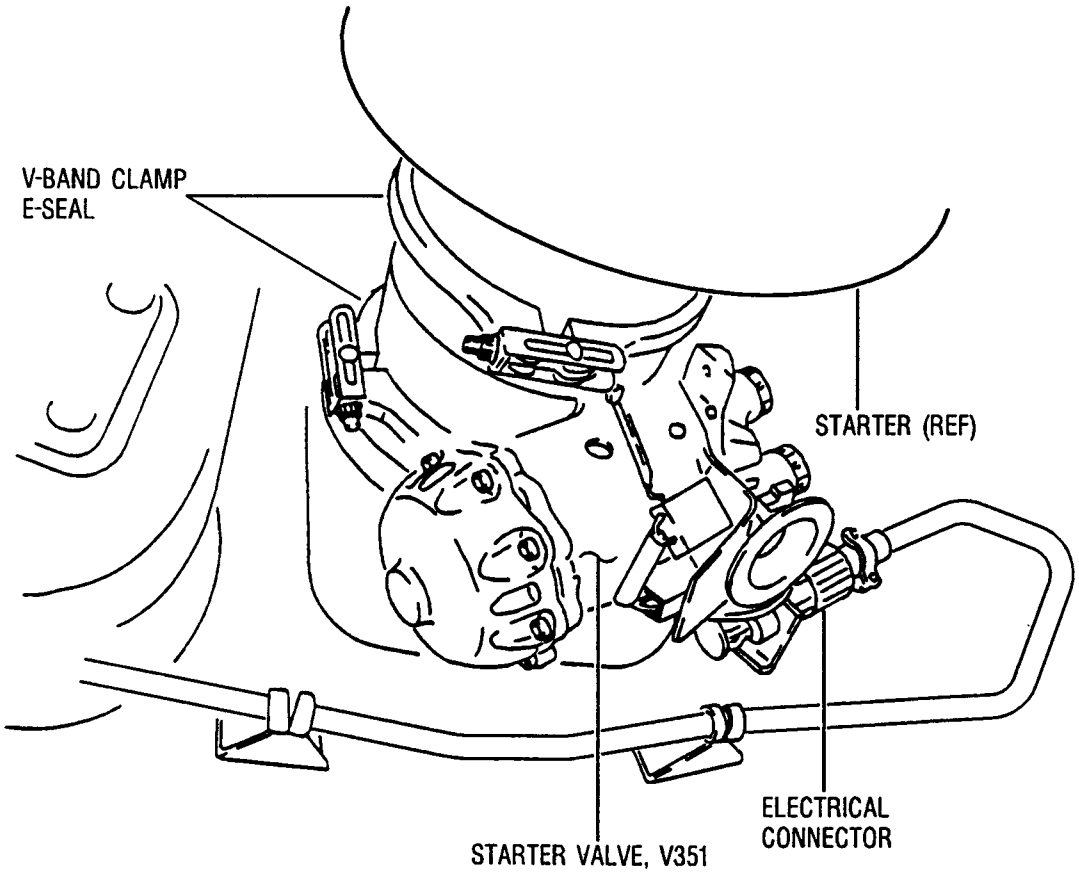
Start Valve Installation (Sheet 1 of 2)
Figure 401



HAMILTON STSNDARD START VALVE

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Start Valve Installation (Sheet 2 of 2)
Figure 401

PNEUMATIC STARTER AIR SUPPLY DUCT - REMOVAL/INSTALLATION

1. General

A. This procedure provides instructions for removal/installation of the pneumatic starter supply duct.

B. Access to the pneumatic starter supply duct is through the right thrust reverser cowl doors.

R C. For inspection/check of the pneumatic starter air supply ducts
R (Ref. 80-13-08, P. Block 601).

2. Equipment and Materials

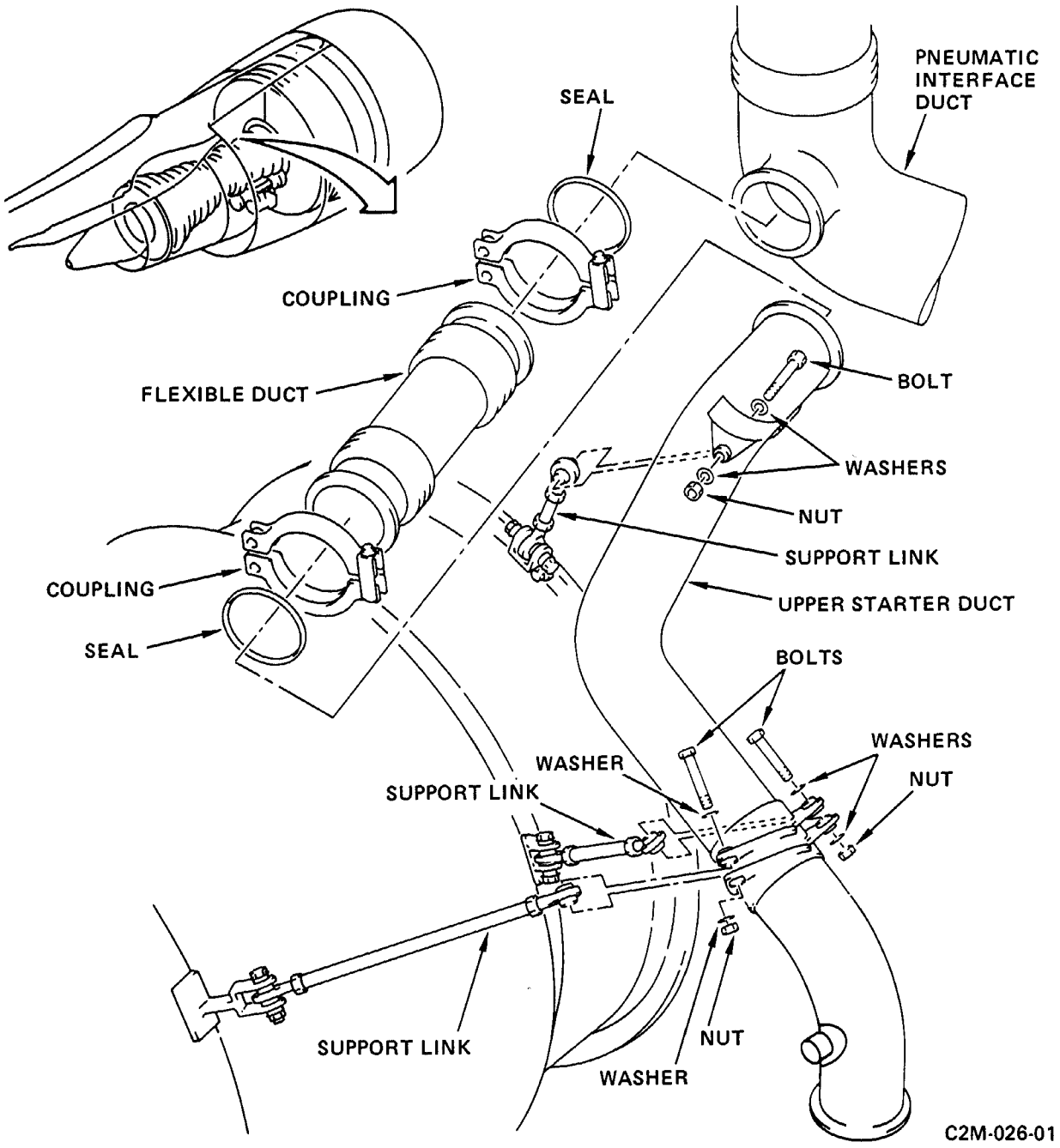
ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Access Platform
Referenced Procedures	
- 71-13-00, P. Block 301	Cowl Door
- 71-00-00, P. Block 501	Power Plant - General
R - 80-13-08, P. Block 601	Pneumatic Starter Air Supply Duct

3. Procedure

A. Job Set-Up
(1)Open, safety and tag the appropriate circuit breakers and open the thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).
(2)Install access platform.

B. Removal (Ref. Fig. 401, 402)
(1)Remove starter supply duct as follows :
(a)Remove couplings and seals attaching flexible duct to upper starter duct and pneumatic interface duct. Remove flexible duct.
(b)Remove bolts, washers, and nuts attaching support links to upper starter duct.
(c)Remove coupling and seal attaching upper starter duct to lower starter duct. Remove upper starter duct.
(d)Remove bolts, washers, and nuts attaching support links to lower starter duct.
(e)Remove coupling and seal attaching lower starter duct to starter valve. Remove lower starter duct.

C. Installation
(1)Install starter system duct as follows :
(a)Attach lower starter duct to starter valve with coupling and seal.
(b)Attach upper starter duct to lower starter duct with coupling and seal.
(c)Attach flexible duct to upper starter duct and pneumatic interface duct with couplings and seals.
(d)Attach links to ducts with bolts, washers, and nuts.



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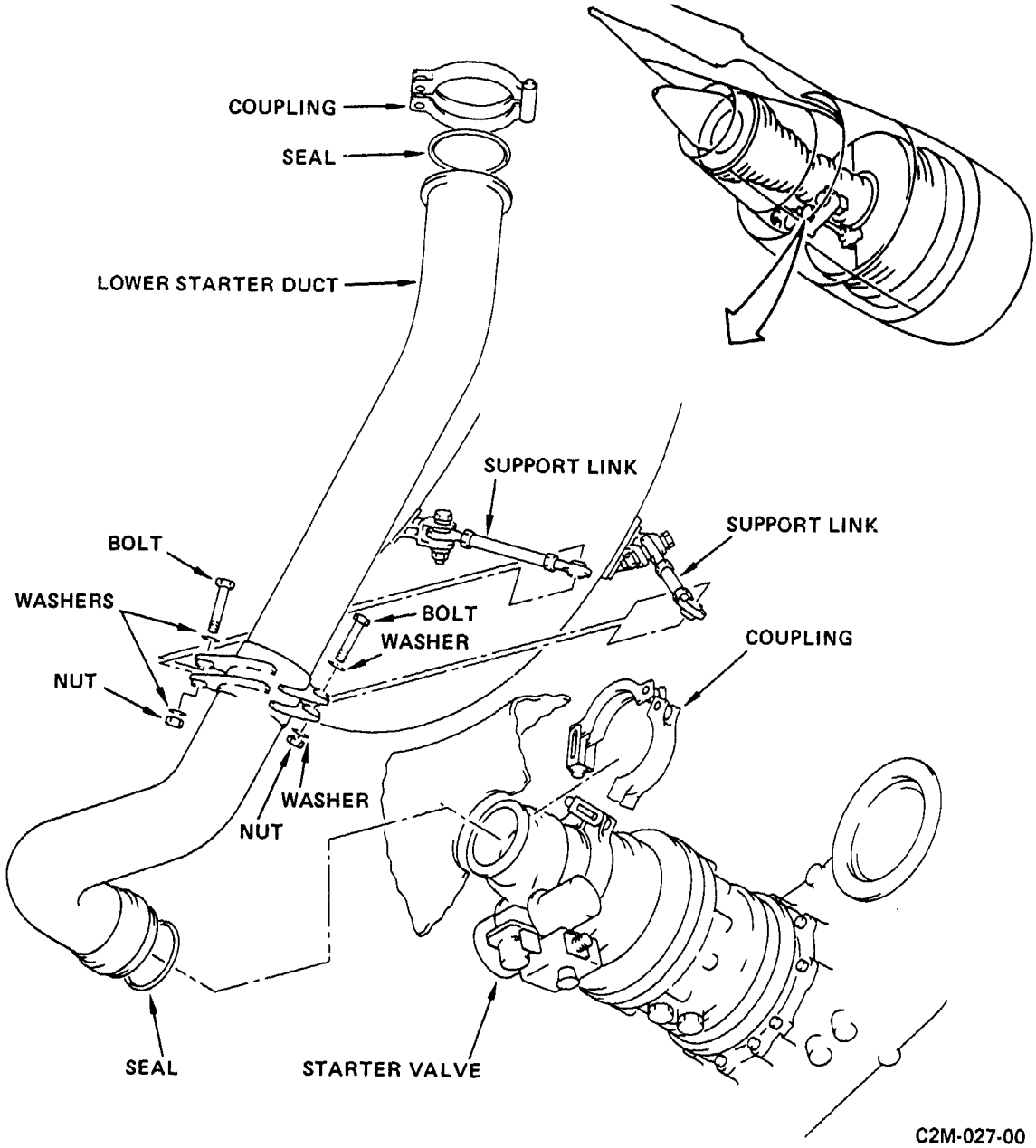
Flexible and Upper Starter Ducts
Figure 401



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Lower Starter Ducts
Figure 402

(e)Adjust length of links as required to relieve preload and to eliminate misalignment of ducts. Check duct alignment by measuring length of flexible duct, from flange to flange, at several points about its circumference. Maximum and minimum lengths must not vary by more than 0.10 in. (2.5 mm). TORQUE nuts to between 50 and 70 lbf.in. (0.56 and 0.79 m.daN).

R (f)TORQUE couplings to between 100 and 115 lbf.in. (1.13 and 1.30 m.daN). Tap outside of couplings with nonmarring hammer and retorque. Tap couplings and retorque again. Tap couplings for a third time. Retorque and safetywire couplings.

D. Close-Up and Test

(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2)Remove access platform.
(3)Remove safety clips and tags and close circuit breakers.
(4)Dry motor engine (Ref. 71-00-00, P. Block 501).
(5)Check for air leakage.
(6)Close fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

PNEUMATIC STARTER AIR SUPPLY DUCT - INSPECTION/CHECK

1. General

A. This maintenance procedure has the inspection/check instructions for the pneumatic starter air supply duct. Access to the starter duct is through the right thrust reverser cowl door.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Access Platform

Referenced Procedures

- 71-13-00, P. Block 301	Cowl Doors
- 80-13-08, P. Block 401	Pneumactic Starter Air Supply Duct

3. Procedure

A. Job Set-Up

(1)Open, safety and tag the appropriate circuit breakers and open the thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

(2)Position the access platform.

B. Visual Inspection/Check (Ref. Fig. 601)

(1)Do a visual inspection of the duct as follows:

INSPECT/CHECK	MAXIMUM SERVICEABLE LIMITS	REMARKS
(a) Examine the duct for :		
1 Loose ducts	Broken, loose, or not aligned support attach bracket, or clamps that attach or connect sections of the ducts, starter, or shutoff valve	Repair or replace the damaged part
2 Holes or cracks	Not permitted	Replace the damaged part
3 Dents, twists, bends, or damage	Not permitted	Replace the damaged part
(b) Examine the support links and mounting brackets, on the engine flange and ducts for:		
1 Looseness, non-alignment, breaks, bends, or other deformities	Not permitted	Repair or replace the damaged part

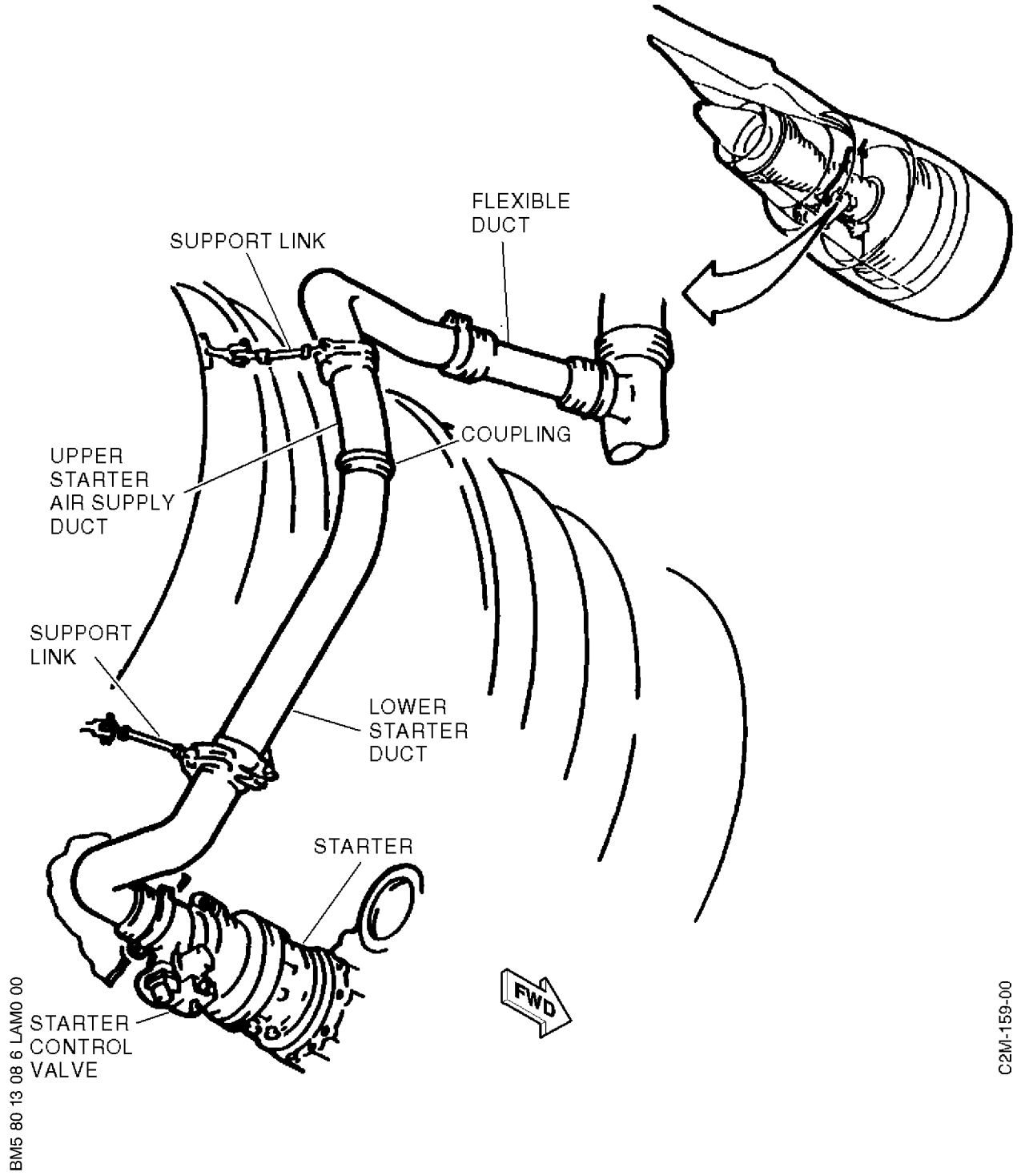
(2)If damage to the duct or the assembly is more than the specified limits, replace the damaged part (Ref. 80-13-08, P. Block 401).

C. Close-Up

(1)Make certain that the working area is clean and clear of tools and miscellaneous items of equipment.

(2)Remove safety clips and tags and close appropriate circuits breakers.

(3)Close the thrust reverser door (Ref. 71-13-00, P. Block 301).



Pneumatic Starter Supply Ducts
Figure 601